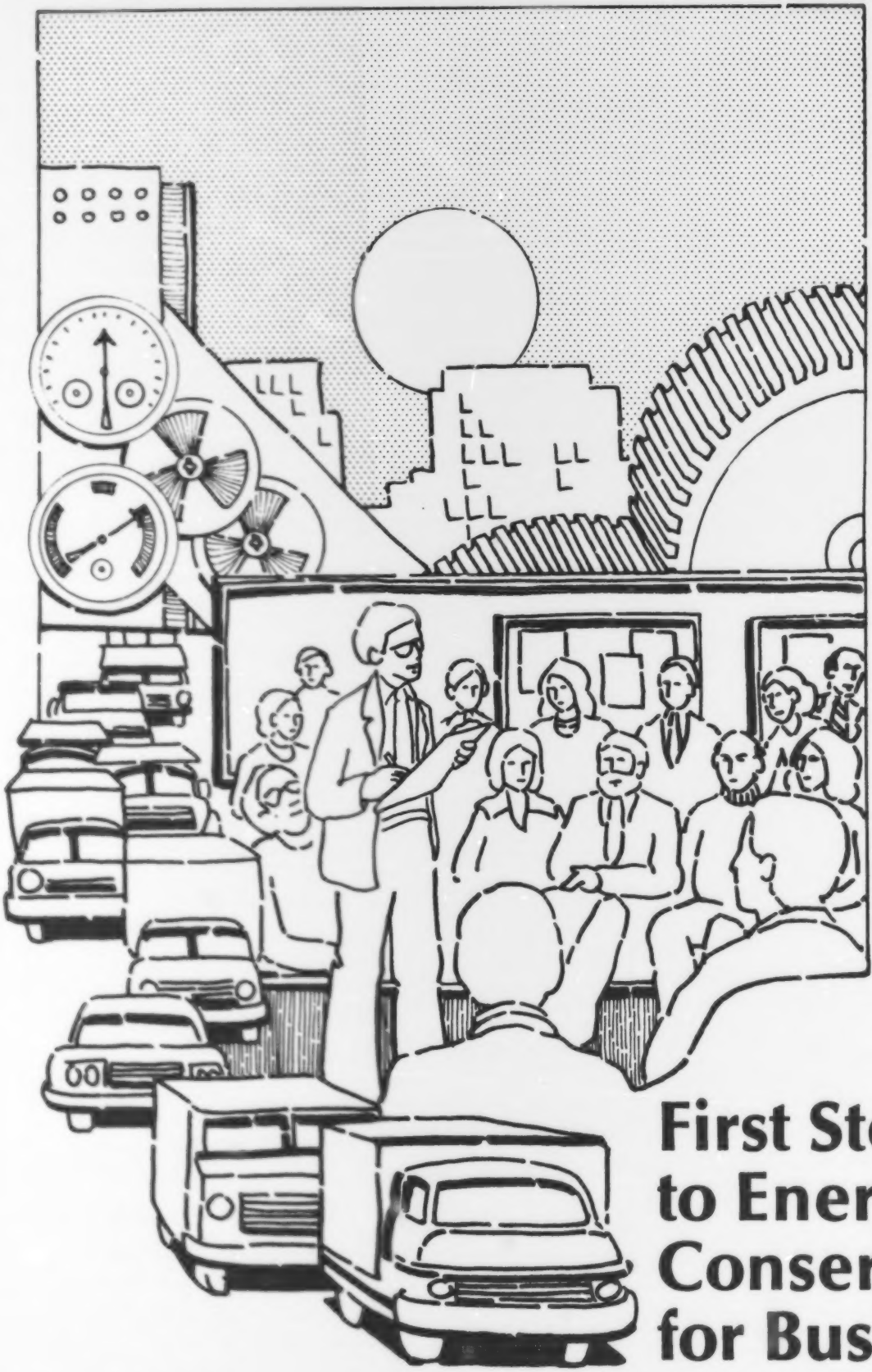

First Steps to Energy Conservation for Business

Energy, Mines and Resources Canada
Energie, Mines et Ressources Canada

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First Steps to Energy Conservation for Business

Conservation and Renewable Energy Branch
Department of Energy, Mines and Resources
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PURPOSE OF THIS BOOKLET

This booklet is an introduction to an energy conservation program for your business; it is the first in a series of booklets dealing with individual industries and processes.

In this publication, we are primarily concerned with the organization of an energy conservation committee and the execution of an energy audit. As energy audit identifies areas where energy is being wasted and spotlights areas with the largest potential for savings. The suggested corrective actions focus mostly on housekeeping measures. Process changes, which are the next step in a conservation program, are much more specific to a particular industry and are dealt with in other booklets available from the Office of Energy Conservation.

Organizing the committee and training the personnel might require some redirection of resources and some rescheduling of work time. However, when the conservation program is in full swing, the time required to record the conservation measures and savings will decrease rapidly — to the point where a line supervisor can do this task in about half an hour a day.

The conservation program and the action suggestion list here are culled from programs in large businesses that have energy experts capable of measuring and demonstrating the value of these ideas. This publication simplifies these programs so that smaller businesses might benefit from the experience and expertise of the large corporations.

We all stand to benefit from the most efficient use of our resources.

INTRODUCTION

In the 1960s, our energy bills were not very high and we thought that Canada's oil and natural gas would last a long time. So we did not worry very much about the growing amount of energy we were using — and wasting.

In 1977, we Canadians will consume *twice as much* energy as we did in 1963, only 14 years ago. And today the price per unit is much higher than it was in 1963. One reason is the high price of foreign oil. Another is the enormous cost of producing our own oil, natural gas, and electricity. We are drilling for oil and gas in the Far North, building expensive nuclear plants, and putting up huge, remote hydro stations so that we can have more and more energy each year.

In addition to raising the price of energy, these new projects cause higher taxes and serious environmental damage. Yet we waste a large portion of the energy we produce. This waste is costing us billions of dollars each year. It is also shortening the amount of time we have to develop new energy sources (e.g., untapped coal reserves, solar power, and wind power) *before* our oil and natural gas is depleted. Canada's oil and gas reserves are not nearly as large as we once thought. In terms of availability of resources, it appears that our best years are just behind us.

By conserving energy you help to build a stronger Canadian economy and to prevent a severe energy shortage. Also, your company saves money. Energy conservation is an excellent investment — one that pays increasing dividends as energy prices go up. There are, however, some implications that are often missed. Notably, conservation of energy is not something to be introduced in a crisis and then dismissed; rather it has to become a long-term and essential component of Canada's policies and of Canadian lifestyles. Further, as one form of energy becomes less available, people will switch to other forms, creating tremendous pressure to expand the supply of the substitute sources. Therefore, conservation must include all sources of energy, in all the regions of Canada, plus all of its uses and all of the users. Transforming Canada into a conserver society will be a profound challenge to us as a nation and as a people, but it is a challenge we cannot ignore.

COMMITMENT

Management: What's in it for us?

In Canada, industry and commerce consume about half of the annual energy supply. Thus a considerable contribution to the national effort to conserve energy can be effected by increasing production efficiency. A more effective use of energy will reduce product costs. This will permit a reduction in price to the consumer — and an increase in your share of the market.

To begin a good conservation program, a company must know how much energy enters and leaves its plant in a given period. To calculate the process energy requirements of your products, see the section "How to Audit Energy." Although the initial audit may be time-consuming, it will be well worth the effort. Manufacturing processes that use large amounts of energy will have been identified and prime areas for conservation pinpointed.

Once the energy-intensive processes are identified, you can concentrate on replacing old machinery and equipment with more efficient designs and on improving maintenance programs.

When domestic oil prices had to be raised, the government introduced the higher prices gradually rather than suddenly, thus cushioning the blow to the economy that resulted from the worldwide price increases. Time has been bought — time to switch from wasteful methods of production to efficient methods.

One of the premises of this two-price system was the government's plan to subsidize imported fuel through funds raised by the taxation of our petroleum exports. However, when the government decided to conserve fuel by limiting the amount of oil for exportation, these tax revenues were not sufficient to offset the payments for imported petroleum and its products. Raising the price would generate capital for the oil industry's exploration projects in high-risk and low-return frontier areas. A continuing low price would encourage the rapid consumption of a nonrenewable resource.

The pressures for higher prices will probably continue, because in the long run the dual price system will delay adjustments to the world price and reduce the efficiency of our economic system.

It can be viewed as an exciting challenge. Those companies that move quickly to meet the challenge can contribute substantially to the solution of a national problem and assure themselves of a competitive position in the markets of the future.

Employees: What's in it for us?

Without an energy conservation program, spiralling energy prices and a lack of easily available energy will lead to major shifts in the labour market. Indeed, the end result may be an acute crisis for labour. A successful conservation program will make your company more competitive and your job more secure. In some cases it will also buy time

for management to make changes that will substitute labour for energy-consuming equipment.

Regardless of which sources of energy Canada chooses to use in the future, the costs of developing them and sending them to their market will be staggering. Our conventional supply of petroleum is rapidly dwindling. In fact, we are already a net importer of oil. As the conventional supplies run out, we must turn to the less conventional sources — the tar sands and the more remote Arctic and offshore areas. Inevitably, substantially more energy and capital will have to be spent to develop each successive unit of energy. If energy demands continue to grow rapidly, Canada will be forced into the simultaneous development of several new sources of energy, all of a highly capital-intensive and risky nature.

This will shift capital from labour-intensive secondary and tertiary industries to capital-intensive primary industries and necessitate major job dislocations throughout the Canadian economy. It will be a step back to an economy based more on primary production and less on labour-intensive manufacturing and service industries. The implications for employment are obvious.

Today, energy conservation is a matter of economics; tomorrow, it will be a matter of corporate survival. In your firm, you may be the one to determine whether an energy conservation program is to be a success or a failure. And your job may depend upon its being a success.

A CONSERVATION PROGRAM

This section describes a general energy conservation program for businesses. It should be used as a guide in the design of your own program.

We have included sample forms and charts for recording and reporting plant survey data and for tracking your progress. These sheets can be used directly or modified to fit your needs. They can be removed from the book and used as masters for duplication.

Essential Components

- **The commitment of everyone in the firm** to the goals of the program.
- **Monitoring the pattern of present energy use,** as explained in the section "How to Audit Energy."
- **Implementation of housekeeping measures** that are indicated by surveys. The results of your energy audit together with the checklists contained in this book will indicate corrective action.
- **Consideration of new and appropriate technology** in regard to energy efficiency and future costs. We will deal with this in more detail in future publications.
- **The monitoring of improvements.** Record all changes in energy consumption on the tracking charts and tabulate the results (see Chart 6).
- **Aggressive promotion of the program** to everyone in your company. This includes communicating the results and benefits of the program to your employees and can extend to promotion of energy conservation in their personal lives.

Some of your individual requirements may not be anticipated by this format, and some of the actions described may not be necessary or appropriate for you. Just the skeleton of an energy conservation program is offered here.

An Energy Audit

The first step in saving energy is to determine how much of the energy used is needed and how much is wasted. The measurement of energy flow requires an audit, which is a survey to show total energy used, how and where it is used, and the fuel intensity of output (British thermal units, or Btu) per unit of output. Numerous forms of energy can be measured and each can be converted to British thermal units (see conversion table, Chart 1).

For your audit, you can design a balance sheet (see "How to Audit Energy"). The balance sheet shows process steps, the theoretical amount of energy required to complete each step, the energy actually used, and the variance between theoretical and actual use. The idea is to set up goals each month to minimize the variance (Chart 2).

If cost considerations and/or lack of personnel make an audit difficult for you, a fuel supplier, machinery contractor, or consulting engineering firm can assist you.

An accurate energy audit will point the way to an imaginative and productive conservation program.

Involvement

As mentioned earlier, a successful energy conservation program requires the participation of everyone on the payroll. But without a strong commitment from top management and their allocation of the needed resources, a *good* program cannot even begin.

Responsibility for the program rests ultimately with the executive; implementation, however, begins with the managers.

Manager's Duties

- To inform the line supervisors of the economic basis for conservation and their accountability for the energy consumed in their areas of control.
- To establish a system in which the people who get the day-to-day work done participate in deciding upon and carrying out the energy conservation program. This organization should consist of a coordinator appointed by management and of a committee of representatives of each department in the plant.
- To provide the conservation committee with guidelines so that they can

  formulate and conduct an energy audit;
  define the goals attainable;
  develop ideas on ways to save energy;
  enlist employee support and participation;
  disseminate the collected information; and
  produce a standard energy accounting system.

Employee Participation

Although a good program cannot begin without the commitment of management, it cannot succeed without the cooperation of employees. They should be

- included on the energy conservation committee;
- consulted on the formulation and operation of the energy audit; and
- involved in the evaluation of the program (assisting in the review of progress and the re-evaluation, and revision if necessary, of original goals).

Here are some suggestions for further involving employees:

Distribution of literature on and showing of films on conservation
Announcement of goals accomplished
Display of newspaper features
A suggestion award plan

HOW TO AUDIT ENERGY

The energy conservation program begins with measurement — the measurement of all energy consumed during a fixed period of time.

To establish precisely the energy input, the energy used, and the energy dissipated or wasted requires a ready availability of data. For this, you must have an energy balance sheet for every process and department (see charts 4*a* and 4*b*).

In some instances, an in-line meter will be necessary. This extra cost should quickly pay for itself.

How to Plan an Energy Budget

An energy budget documents the relationship between the energy input and the work output (see Chart 2). If they are not equal, the difference is waste. No process or conversion will be 100% efficient; there is always some waste. For example, the maximum efficiency of an internal combustion engine is limited by thermodynamic principles. The goal, however, is to reduce waste to a minimum.

- The total energy input must be measured. The audit will give this information for the entire plant, but for a single process additional metering must be available (see charts 4*a* and 4*b*).
- The theoretical input must be calculated. An example for a single process is given below.
- The ratio of output to input is the efficiency, and the difference between them is waste. A feasibility study should be carried out on the most wasteful processes in order to derive a cost/benefit evaluation for the reduction of this waste.
- An approach to discovering major areas of waste is suggested in Chart 5.

Example of an Energy Budget for a Single Process

Suppose steel parts are to be washed at the rate of 100 lb/hr for 8 hr per day in a tank of hot water held at 150°F, with make-up water being added at the rate of 1 gal./hr (see Appendix B).

The tank is filled with 50°F water at 7 A.M. Monday and heated to 150°F in 1 hour. Its temperature is maintained until 5 P.M. Friday, when the tank is dumped.

The theoretical energy required will be as follows:

	Btu
Heat up water and tank	57 760
Wash steel (960 × 8 × 5)	38 400
Heat make-up water (1000 × 8 × 5)	40 000
Minimum total weekly heat required	136 160

If a meter were placed on this tank for a week, theoretical calculations show that a total input of 1 233 360 might be consumed.

Therefore, the amount of heat lost might be 1 233 360 − 136 160 = 1 097 200 Btu each week.

This would mean that 90% of the heat input is lost by radiation from the tank walls and by evaporation from the surface.

This can be reduced by insulating the tank walls and by covering the top with plastic spheres especially made for this purpose.

The metered input of heat might be reduced to 327 710 Btu per week and the theoretical loss reduced to 327 710 − 136 160 = 191 550 Btu each week.

The theoretical energy could thus be reduced from 1 233 360 Btu to 327 710 Btu, or a reduction of 73.5%.

First Survey — Housekeeping

Your first survey should be aimed at energy wastes in housekeeping (see charts 3, 4*a*, 4*b*). Some examples of these:

Inadequate insulation
Machinery functioning when not in use
Steam leaks
Unserviced or untuned furnaces
Unnecessary heating
Unneeded lighting

Second Survey — Processes, Departments, and Products

The second step is to develop an energy report for each process, department and product (see charts 4*a* and 4*b*). This report must specify

a) the total input of energy in Btu (excluding raw-materials energy, which we will deal with in supplemental publications);
b) the total number of units of each product turned out; and
c) the total conversion Btu per unit of product.

Third Survey — Analysis

After developing all the process energy balances, carefully analyze them to determine whether

a) waste heat can be recovered to generate steam or electricity or to heat water, raw material, or space;
b) processes may be discarded or altered to increase energy efficiency;
c) inefficient equipment can be replaced; and
d) alternate energy sources having a more secure supply or renewable nature can be used.

Fourth Survey — Nonworking Hours

The conservation committee should carry out an audit on weekends and nights when the plant is not operational. This will indicate the amount of energy used in nonworking hours.

Fifth Survey — Systems and Equipment

The conservation committee should survey (see Chart 5)

a) the heating and air conditioning system;
b) steam systems;
c) electric motors;
d) natural gas systems; and
e) compressed air systems.

Implementation

The most important step is the implementation of the decisions made after the audit has been thoroughly analyzed.

First, correct the housekeeping wastes identified in the first survey (see Chart 3).

Second, record all conservation proposals that result from the analysis of the audits. Evaluate each one and select the most rewarding for immediate implementation (see charts 3, 4*a*, 4*b*):

a) Calculate annual energy savings for each proposal.
b) Project future energy costs and calculate annual dollar savings.
c) Estimate capital or expense costs.
d) Evaluate investment merit using measures such as return on investment, etc. (see section "Return on Investment" below).
e) Assign priorities, based on investment merit, to projects.
f) Request capital authorization.

Long-Range Planning

Finally, reassess all proposed capital projects as regards energy efficiency. Keep in mind the future cost and the security of supply of the type of energy you choose.

Return on Investment

The following are the cost items of equipment designed to conserve or recover energy:

First cost (labour and materials) (FC)
Annual operating cost (in dollars) (AOC)

Projected fuel price (unit price at time of start-up) (PFP)
Estimated lifetime (of equipment) (EL)
Annual fuel saving (in units) (AFS)
Net annual saving (in dollars) (S)
Pay-back period (in years) (PP)
Depreciation charge (dollars/year) (DC)
Return on investment (% per year) (ROI)

In the following equations, substitute your own figures for the cost items:

$$S = AOC - (AFS \times PFP)$$

$$PP = \frac{FC}{S}$$ (compare with expected lifetime of investment)

$$DC = \frac{FC}{EL}$$

$$ROI = \frac{S - DC \times 100\%}{FC}$$ (look for 15 – 20% after taxes)

$$\text{Simple calculation of ROI} = \frac{55\,(S - 10\%\ FC)\ \%}{FC}$$

This calculation, used by some firms, takes into account the amount of investment money left after taxes (55%).

ARE YOU KEEPING UP WITH YOUR COMPETITORS?

A major hotel and restaurant chain has cut back on decorative lighting, reduced the temperature of hot water provided to customers, and shut down escalators and some elevators during quiet hours.

One company has cut gasoline consumption by 20% by making less frequent deliveries and maintaining a smaller fleet of trucks.

In Hamilton, a major steel producer has introduced a computer program to monitor the company's energy flow.

Ontario Hydro's new head office has a heating system that uses three huge tanks to collect water that is circulated through the building, exchanging hot for cold to suit the conditions. It may save as much as $150,000 yearly.

One company has lowered the temperature of hot water to all restrooms and closes all draperies at night to lessen heat loss from the glassed-in areas.

Also to lessen heat loss, another firm keeps all exterior doors, especially loading dock and garage doors, closed when possible.

One has reduced elevator service after the normal working hours.

Another has shortened the workweek to 35 hours from November to March. Employees return to the 40-hour week in March.

And another has shortened the regular shift (8:30 A.M. to 5 P.M.) to 8.30 A.M. to 4:30 P.M. by limiting the lunch hour to 30 minutes. There have been very few complaints from employees, most of whom prefer the new hours.

One enterprise has removed tubes from every other fluorescent fixture in hallways and non-work areas. It reports that the total kilowatt usage decreased by 15% over the previous year.

Another has turned off half of the lights in the company parking lots.

One has its offices cleaned two hours earlier than formerly, thus using less electricity for lighting.

A manufacturing firm gives employees cars with the most passengers the prime parking spaces: the fewer the people per car, the longer the walk to the office.

A utility company requests meter readers to shut off their car motors when they park in order to take a reading.

Another employer has begun a flexible time program. Employees can begin work any time from 7 to 8:30 in the morning and leave any time from 3:30 to 4:45 P.M. This way they can avoid the rush-hour traffic and its high rate of gasoline consumption.

A tire company burns old tires to heat a boiler. Pound for pound, tires have about 50% more heating value than coal.

A major company reports that several of its offices around the country have reduced the number of cooling towers used in the air conditioning system, caulked all window and air leaks, cut off steam and hot water on the weekends, used decals on light switches, which are colour coordinated to be left off at all times or just in the evenings, given the cleaning crew cards to leave as reminders on the desks of people who forget to switch off their lights, and (to save on air conditioning and on heating) relaxed dress codes to permit sport shirts in hot weather instead of ties and coats and warm sweaters and jackets in winter.

One establishment is considering installation of a computerized system that will automatically reduce lighting by 85% when people vacate floors at 5 P.M. and 95% when janitors finish their work.

A pulp and paper enterprise in B.C. generates most of its power from its own waste material.

Scrap lumber has been made available for use in fireplaces and furnaces by one lumber company.

A transport company is now dispatching only fully loaded trucks and has lowered the gear ratios in tractors so that fuel burns more economically at lower speeds.

Another company turns off office lights at 5:15 P.M. instead of leaving them on until the clean-up crews do it at 10:00 P.M.

The employees in another are given a $25 quarterly bonus if they forego driving to work and relinquish their parking lot stickers.

Also encouraging employees to use public transportation rather than private cars, one major employer has plotted on a city map the areas where employees live, then posted the map along with city bus routes and schedules on the company bulletin board.

By paying its employees a one-dollar bonus for every two dollars worth of electricity and fuel saved in comparison with the electricity and oil consumption from the previous year, one firm hopes that the employees will turn off lights and keep the thermostat down.

Another is reimbursing each employee half of the fare paid for public transportation to and from work.

CHECKLISTS FOR CONSERVING ENERGY

Some of the following measures may not be suitable for your system or may even be counterproductive, so check carefully before acting on them.

These suggestions have been compiled from many different sources. If you have any additional ideas, please pass them on to us.

Air Conditioning and Heating Systems

Air Conditioning

Turn off air conditioning in all unoccupied areas such as empty offices, hallways and conference rooms.

Use humidity-controlling systems that allow the humidity to rise to the highest acceptable setting. Systems that use reheat are particularly beneficial.

Reduce or eliminate heat-producing lights and appliances.

Leave storm windows and doors in place during the summer to prevent outside heat from coming in.

Be sure your air conditioning system is in good working order by keeping filters, coils and blowers clean.

Insulate and ventilate crawl spaces in the roof, and install an exhaust fan to draw out hot air.

Use water-cooled lighting fixtures if possible.

Use spot coolers when spaces are occupied only at irregular times.

If the office is vacant after closing hours, turn off the air conditioning an hour before quitting time. The temperature will increase only gradually.

If possible, use heat-producing equipment such as photocopiers in the early morning or late afternoon only.

Install awnings or shades to block out sunlight.

Paint the walls on the south and west sides of your buildings in a light colour. This will reflect rather than absorb heat.

Urge employees to wear lightweight clothing to accommodate themselves to a slightly higher temperature.

Restrict employee smoking so you will not have to ventilate so much.

Heating

Discontinue humidity controls during nonworking hours. Reduce the temperature in all public spaces such as lobbies, restrooms and hallways, as people are usually in these places a very short time.

Operate ventilation systems only when necessary, not on a continuous basis.

Encourage the wearing of heavier clothing in cold weather.

Be sure the heating equipment is in good operating condition. Clean all air intakes and heat transfer surfaces. Have your furnace checked and tuned regularly.

If group work must take place after hours, ask employees to concentrate if possible in one heated area instead of scattering throughout the office or building.

Install storm windows and doors and/or caulk all windows and doors.

Insulate crawl spaces and heating ducts against hot air leakage.

Install heat-recovery devices in outgoing ventilation ducts to heat incoming air.

Install automatic ignition devices where pilot lights are used. Gas pilot lights in furnaces and boilers can use up to 24 cubic feet of gas per day.

Install automatic door closers or revolving doors to outside exits.

Drop the thermostat setting. For each degree you lower it, you save 3% of energy used. Set back thermostat further at night.

Do not allow the use of portable space heaters in the offices. Their wattage is high.

Keep all air grills clean.

Lower water temperature in all restrooms.

Check pipes and sinks for leaks.

Humidity should be kept high to increase comfort at lower temperatures.

Buildings and Grounds

Immediate Action

Reduce ventilation air.

Increase light reflectance of walls and ceilings.

Eliminate unused roof openings or abandoned stacks.

Reduce glazed areas in buildings.

Reduce temperature of service hot water.

Install timers on light switches in little-used areas.

Close holes and openings in buildings such as broken windows, unnecessary louvers and dampers, cracks around doors and windows.

Repair faulty louvers and dampers.

Shut off water coolers and vending machines at night.

Schedule use of elevators and escalators to conserve energy; use only one elevator and shut down escalator during off-peak times.

Other Suggestions

Reduce air conditioning load by evaporating water from roof.

Convert to fluorescent, mercury, sodium, or high-intensity direct lighting.

Insulate walls, ceilings and roofs.

Periodically calibrate the sensors controlling louvers and dampers on buildings.

Eliminate inefficient electric lamps from plant stocks and catalogues.

Clean air conditioning refrigerant condensers to reduce compressor operation time.

Use 'heat wheel' or other heat exchanger to cross-exchange building exhaust air with make-up air.

Use photocell controls on outdoor lights.

Use building materials that require less energy to produce.

Size air-handling grills, ducts and coils to minimize air resistance.

Utilize recovered heat in waste service hot water.

Avoid introducing high-moisture exhaust air into air conditioning system.

Use direct air supply to exhaust hoods.

Use exhaust heat from buildings for snow and ice removal from walks, driveways, parkways, parking lots, etc.

Use separate switches on perimeter lighting so that it can be turned off when natural light is available.

Use double- or triple-glazed windows to maintain higher relative humidity and to reduce heat losses.

Heat water during offpeak periods and store in well insulated containers for later use.

Use heat pumps for space conditioning.

Heat service hot water with air conditioning compressor exhaust.

Reduce or eliminate general lighting where natural light provides sufficient illumination. Limit higher lighting levels to task areas.

Reduce illumination of grounds and of exteriors of buildings to minimum safe level.

Interlock heating and air conditioning systems to prevent simultaneous operation.

Recycle air for heating, ventilation and air conditioning to maximum extent.

Replace air curtain doors with solid doors.

Reduce solar heat gain by tinting windows or by installing tinted ones.

Lighting Systems

Use light colours on ceilings, walls, floors and furnishings to reflect rather than absorb light.

Use efficient light sources by referring to the following:

Incandescent Lamps

lamp	lumens/watt
40-watt general service	11
60-watt general service	14.3
100-watt general service	17.4
100-watt extended service	14.8
1000-watt general service	22

Fluorescent Lamps

cool white lamps	lumens/watt
2 x 24 in.	50
2 x 48 in.	67
2 x 96 in.	73

HID Lamps

lamp	lumens/watt
400-watt phosphor-coated mercury	46
400-watt metal halide	74
400-watt high-pressure sodium	100
1000-watt metal halide	85

Turn off all unnecessary lights.

Reduce or eliminate decorative lighting inside and outside the building.

Lower the wattage of all lights where practical.

Open curtains and shades for more light during daylight hours.

Keep bulbs and fixtures clean and free of light-blocking dirt.

Transportation

Keep Speed Down. Tests conducted with popular American cars have indicated a 25% improvement in fuel economy when speeds are reduced from 79 to 59 mph. Wind resistance increases as car speeds increase, and more energy is required to move the car.

Avoid 'Jack Rabbit' Starts. Gradual rather than rapid acceleration can save as much as 2 miles per gallon of gasoline. That's because it takes a lot of extra energy to increase an automobile's acceleration rate. A power valve located in the carburetor lets more fuel into the cylinders under full acceleration. In addition, an accelerator pump provides extra fuel to avoid hesitation when the gas pedal is jabbed.

Keep Speeds Constant. Driving at steady speeds helps to save gasoline. Unnecessary acceleration activates the accelerator pump and power valve, injecting extra fuel into the system.

Anticipate Stops. Plan ahead for all possible traffic conditions. This allows for gradual rather than abrupt stops, which contributes to better fuel economy. In addition, gradual braking prolongs the life of brake linings.

Plan All Trips. Plan each car trip to cover as many errands or deliveries as possible. A-1-mile trip with the engine cold may decrease fuel economy by as much as 70%. Combustion is relatively inefficient in a cold engine, and the automatic choke must supply more fuel to keep a cold engine running smoothly. A longer trip, which allows the engine to warm up, uses less fuel than a series of shorter trips.

Avoid Engine Idling. An idling engine wastes energy; it does no useful work while consuming fuel. Excessive idling may also shorten engine life. Try not to idle the engine for more than one to three minutes at a time.

Warm Engine by Driving. Drivers will obtain better economy by driving the car to warm the engine rather than allowing it to idle excessively. This speeds up the warming process and thus saves gasoline. The driver must remember, however, that a cold engine does not respond as quickly, so care must be exercised in all traffic situations where engine response is critical.

Minimize the Use of Air Conditioners. Air conditioning puts a substantial load on automobile engines and should, therefore, be used only on the hottest days. When you drive at 30 mph, the use of air conditioning can lessen your mileage per gallon of gas by 2 miles. As a rule, use of the air conditioner cuts mileage by 10%. Do you need an air conditioner? It adds extra weight whether you use it or not.

Consider Car Weight. The one factor that has the greatest influence on gas consumption is the curb weight of the vehicle. The more it weighs, the

(text continued on p. 13)

Chart 1 CONVERSION FACTORS

1 tonne (t)	=	1000 kg = .985 long ton = 2205 lb
1 cu metre (m^3)	=	35.3 cu ft
1 metre (m)	=	39.37 inches = 3.28 feet
1 tonne	=	300 U.S. gallons
1 tonne	=	7 barrels (bbl)
1 tonne/year	=	.02 bbl/day
1 barrel	=	42 U.S. gallons
1 barrel	=	35 Cdn. gallons
1 Btu	=	1054.8 joules (J)
1 Btu	=	1.0550 x 10^{10} ergs
1 Btu	=	.252 kilogram-calories

Fuel	Unit	Btu ('000 000) multiply by:
Cdn. bituminous	short ton	25.2
Lignite	short ton	13.2
Coke	short ton	24.8
Liquified pet. gases	bbl of 35 Cdn. gal.	4.095
Crude oil	bbl of 35 Cdn. gal.	5.803
Motor gas	bbl of 35 Cdn. gal.	5.222
Diesel	bbl of 35 Cdn. gal.	5.8275
Light fuel oil	bbl of 35 Cdn. gal.	5.8275
Heavy fuel oil	bbl of 35 Cdn. gal.	6.2874
Aviation gas	bbl of 35 Cdn. gal.	5.0505
Aviation turbo fuel	bbl of 35 Cdn. gal.	5.4145
Natural gas	'000 cu ft	1.07/1.0
Electricity	'000 kwh	3.4120

1 toe	=	107 kcal
1 Mtoe	=	10^{13} kcal
	=	3.968 x 10^{13} Btu
1 million tonnes coal	=	.7 Mtoe
coke	=	.67 Mtoe
patent fuel	=	.7 Mtoe
lignite briquettes	=	.48 Mtoe
1000 million m^3 natural gas	=	.9 Mtoe
manuf. gas	=	.42 Mtoe
1 Twh electricity	=	.086 Mtoe
1 tonne aviation gasoline	=	9.074 bbl
motor gasoline	=	8.691 bbl
kerosene	=	7.776 bbl
gas/diesel oil	=	7.353 bbl
lubricating oil	=	7.004 bbl
heavy fuel oil	=	6.780 bbl
Algeria-Sahara crude oil	=	7.713 bbl
Kuwait crude oil	=	7.263 bbl
Libya crude oil	=	7.593 bbl
Venezuela crude oil	=	7.005 bbl
average (others) crude oil	=	7.3 bbl crude oil
	=	1.034 toe
natural gas liquids	=	10.919 bbl
refined products:		
1 tonne liquified petroleum gas	=	11.8 bbl crude oil
	=	1.193 toe
aviation gas	=	8.9 bbl
kerosene	=	7.73 bbl
gasoline	=	8.53 bbl gasoline
	=	1.128 toe
jet fuel	=	7.93 bbl jet fuel
	=	1.133 toe
gas/diesel (distillate) fuel oil	=	7.46 bbl fuel oil
	=	1.095 toe
residual fuel oil	=	6.66 bbl fuel oil
	=	1.055 toe
1 cu ft natural gas	=	.028317 m^3

Chart 2

ENERGY BUDGET

Buildings and grounds	Theoretical Energy Requirement	Actual Energy Used	Variance between Theory and Practice	Goal	Change from Previous Month
Heating					
Shipping					
Lighting					
Machinery					
Receiving					
Laboratory					
Shop					
Assembly					
Combustion					
Waste disposal					
Cooling					

Chart 3

ENERGY CONSERVATION SURVEY
(sample sheet)

Dept _____ Date _____

	Fuel Gas or Oil Leaks	Steam Leaks	Com-pressed Air Leaks	Con-densate Leaks	Water Leaks	Inade-quate Insulation	Excess Lighting	Equipment Operating Unneces-sarily	Burners Out of Adjust-ment	Unneeded Heating or Air Cond.	Photocopy Machine			Date Corrected
Shipping														
Receiving														
Laboratory														
Shop														
Assembly														
Chemical Storage														
Combustion														
Furnace Room														
Utilities														
Admin: Offices														

Chart 4a)

MONTHLY ENERGY USE BY DEPARTMENT

Dept _____ Date _____

19__	Electric Power			Natural Gas			Fuel Oil			Coal			Compressed Air			
	MWh	Btu/MWh	Btu	Mcu ft	Btu/ Mcu ft	Btu	gal.	Btu/gal.	Btu	tons	Btu/lb	Btu	Mcu ft	Btu/ Mcu ft	Btu	
Jan.																
Feb.																
Mar.																
April																
May																
June																
July																
Aug.																
Sept.																
Oct.																
Nov.																
Dec.																
Total																

Chart 4b)

MONTHLY ENERGY USE BY DEPARTMENT

Dept _____ Date _____

19__	psig Steam			Condensate Used or Lost			Water			Total Conversion Btu	No. of Units Produced	Conversion Btu per Unit of Production	
	M lb	Btu/M lb	Btu	M lb	Btu/M lb	Btu	M lb	Btu/M lb	Btu				
Jan.													
Feb.													
Mar.													
April													
May													
June													
July													
Aug.													
Sept.													
Oct.													
Nov.													
Dec.													
Total													

Chart 5 ENERGY-CONSERVATION CHECKLIST

Dept _____ Date _____

Steam Systems

Steam at _____ psi, _____ pph winter peak, _____ pph summer demand

1. Is steam being used at proper pressure for the application? _____
2. Is piping insulation adequate? _____
3. Are all steam traps operating properly? _____
4. Are additional steam traps needed? _____
5. Is all condensate returned to the boiler? _____
6. Can thermal fluids be used for more efficient heating? _____

Comments _____

_____

Air Management Systems

1. Are proper temperatures maintained both summer and winter? _____
2. Is humidity control adequate for the operation? _____
3. Is the area properly insulated to minimize heat loss? _____
4. Are exhaust ducts located close to source of fumes? _____
5. Is provision for make-up air adequate? _____
6. Is exhaust from processes such as spray booths automatically controlled? _____
7. Can amount of exhaust air be reduced? _____
8. Is heat recovered from exhaust air? _____
9. Can heat loss be reduced from doors, windows? _____
10. Can timers control heaters, fans, chillers more efficiently? _____

Comments _____

_____

Compressed Air

Consumption _____ cfm at _____ psi

1. Are there any leaks in compressed air piping? _____
2. Can small compressors handle after-hours loads? _____
3. Is compressed air properly dried at the compressor? _____
4. Is compressed air properly lubricated where needed? _____
5. Is oil-free air supplied where necessary? _____
6. Are compressed air pressures properly matched to the application? _____
7. Can lower-pressure air be substituted for high-pressure air? _____

Comments _____

_____

Electricity

Voltages available _____, peak electrical demand _____

Total hp induction motors _____, power factor _____

1. Can peak demand be reduced by cycling noncritical loads? _____
2. Is power factor correction adequate? _____
3. Should synchronous motors be used on larger loads? _____
4. Is voltage adequate on all circuits? _____

Comments _____

_____

Lighting

Lighting supplied by (no.) _____ (type) _____

fixtures rated at _____ watts

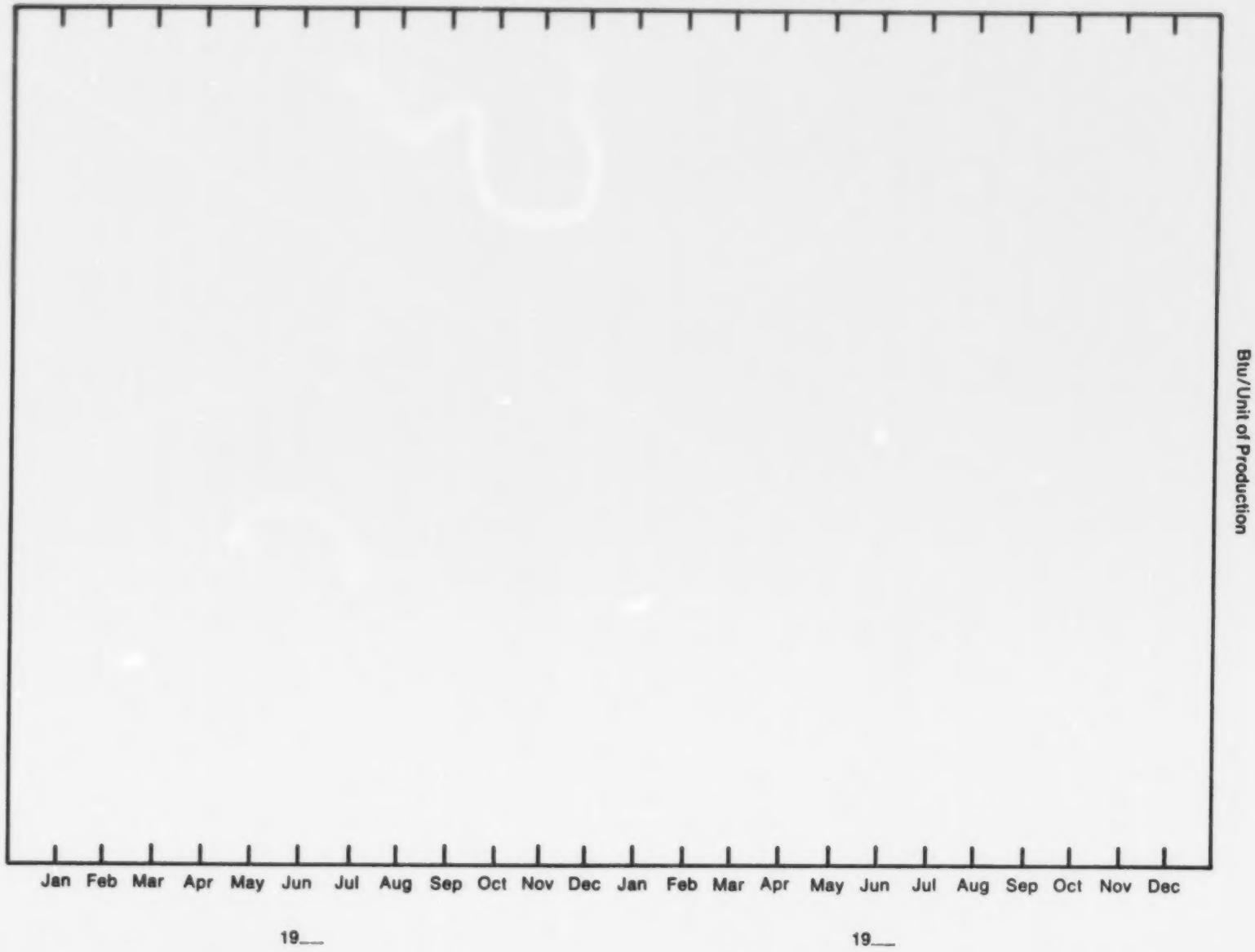
1. Is lighting level suitable for type of activity in the area? _____
2. Who is responsible for turning lights off when not needed? _____
3. Are lighting circuits designed to allow minimal safety lighting? _____
4. Can timers, photoswitches, control exterior lighting? _____
5. Can incandescent lights be replaced with more efficient types? _____

Comments _____

_____

Chart 6

TRACKING CHART
ENERGY USE PER UNIT OF PRODUCTION



poorer the mileage. Before you buy, find out the curb weight of each model you are interested in and work out rough mileages to be driven and fuel costs.

Maintain Correct Tire Pressure. Underinflated tires reduce gas mileage significantly. They also wear out more quickly and may adversely affect vehicle handling, creating a potential safety hazard. For greatest economy, inflate tires to the maximum *recommended* pressure. It is important to check pressure every two weeks as pressure decreases with time. Never inflate above maximum recommended pressure. Radial tires reduce rolling resistance and thus fuel consumption.

Keep the Engine Tuned Up. Spark plug misfiring may increase fuel consumption significantly. In laboratory tests at speeds of 30 and 50 mph, spark plugs misfiring 10% of the time resulted in an 8% increase of fuel consumption. In addition, deviation of ignition timing from the manufacturer's setting decreases gas mileage. For example, a 10-degree retardation in basic spark timing may lose an average of 1.3 miles per gallon at speeds of 30, 50 and 70 mph. Remind your drivers that these and other obstacles to efficient engine performance can be eliminated with a complete tune-up.

Service Air Filter. A dirty air filter can decrease gas mileage and power output by restricting the flow of air to the engine. Service men should, therefore, be advised to change the air filter at specified intervals or according to the manufacturer's recommendations. In addition, frequent air filter servicing is required if considerable driving is done in sandy or dusty conditions.

Lubricate. A properly lubricated engine means less friction between moving parts. Consult your maintenance manual for the proper lubricants to use and for frequency of change.

Avoid Gasoline Spillage. Follow usual good practices at the pump island to prevent spillage and wasting of gasoline. For example, see to it that the attendant does not overfill the gasoline tank, as is sometimes done by dispensing more fuel after the automatic nozzle has shut off.

Do Not Ride the Brakes. Even slight foot pressure on the brake pedal can apply the brakes, especially power brakes. This wastes fuel energy. It also wears the brakes out faster than normal.

Keep Transmission in High Gear. Keep both automatic and manual transmissions in the highest gear possible. With manual transmission, shift into high gear as soon as you can; with automatic transmission, use a light foot on the accelerator to encourage the transmission to shift into high gear quickly. These actions will save gasoline.

Minimize Loads. Transporting unnecessary weight in your car will cause it to use more fuel. The difference is not great on level ground but it does show up when you climb a hill. Also, you will probably have to use your brakes more often.

Service the Manifold Heat Control Valve. The manifold heat control valve should be inspected and serviced periodically. This valve, located in the exhaust system of some vehicles, allows exhaust gases to heat the intake manifold during cold-engine operation. These gases heat the areas under the carburetor to aid in the vaporization of gasoline while the engine is cold. As the engine warms up, a temperature-sensitive spring causes the valve to direct all of the exhaust gases to the exhaust pipe and away from the intake manifold. A valve stuck in the open position causes slow engine warm-up and poor cold-engine performance. A valve stuck in the closed position causes loss of power and hard starting with a hot engine. A valve stuck in either position makes the engine use more fuel.

Have Wheels Aligned. 'Toe in' or 'toe out' wheel misalignment drags your front tires sideways and causes premature tire wear. It takes power to do this extra work, and that takes gas from your tank.

Have Automatic Choke Checked. Your automatic choke should be checked periodically. It regulates the gas/air mixture used in starting and warming the engine.

Check Shipping Area. Turn off truck engines while loading, unloading, or waiting. Close loading dock doors when not in use, and turn out lights above stacked material. Install air seals around loading dock doors. Evaluate energy use in packaging.

Big Trucks — Possible Fuel Savings

The following is a breakdown of how engine power is used.

	% of total power consumed
air resistance	45
drivetrain	13
rolling resistance	36
accessory	6

At 50 mph, 57 HP is required to overcome wind resistance.

at 55 mph	75 HP
60 mph	97 HP
65 mph	123 HP
70 mph	157 HP

A truck with a gross vehicle weight of 78 000 lb will require

144 HP to overcome rolling resistance at 50 mph
160 HP at 55 mph
172 HP at 60 mph
188 HP at 65 mph
200 HP at 70 mph

Save Fuel

Lower the speed to a maximum of 50 or 55 mph.

Retrofit your trucks with streamlining spoilers.

Buy diesel-fueled trucks.

Use radial tires (they lower rolling resistance).

Maintain engine temperature at a higher level. This will result in 27% less wear and a 5% fuel saving for a gasoline-powered engine.

Install a radiator shutter system. It can provide an 8–13% fuel saving over the thermatic fan system.

Encourage the use of double trailers for trucks.

For more detailed information contact your Provincial trucking association for trucking association publications.

Electrical Power

Use combined-cycle gas turbine generators with waste-heat boilers connected to turbine exhaust.

Replace steam jets on vacuum systems with electrically driven vacuum pumps.

Size electric motors for peak operating efficiency.

Use power during off-peak periods. Store heated/cooled water for use during peak demand periods.

Use steam pressure reduction to generate power.

Use immersion heating in tanks, melting pots, etc.

Reduce load on electric conductors to reduce heating losses.

Optimize plant power factors.

Use byproduct heat from transformers for service water heating.

De-energize excess transformer capacity.

Properly maintain and lubricate motor-driven equipment.

Consider energy efficiency when purchasing new equipment.

Consider power loss as well as initial loads and load growth in sizing transformers.

Schedule operations to minimize electrical demand.

Use multiple-speed motors or variable-speed drives for variable pump blower and compressor loads.

Insulate tanks containing heated or cooled liquids by covering walls with insulation and open tops with hollow plastic spheres.

Steam

Immediate Action

Turn off steam tracing during mild weather.

Maintain steam jets used for vacuum system.

Repair leaks in lines and valves.

Repair insulation on condensate lines.

Repair faulty insulation on steam lines.

Repair or replace faulty steam traps.

Eliminate leaks in high-pressure-reducing stations.

Cover condensate storage tanks.

Other Suggestions

Consider replacing electric motors with back-pressure steam turbines, and use exhaust steam for process heat.

Operate distillation columns at minimum quality requirements.

Operate distillation columns at near flooding conditions for maximum separation efficiency.

Determine correct feed plate location on distillation columns to increase efficiency and minimize steam consumption.

Consider switching selected steam stripping distillation units from direct (live) steam to indirect (dry) stripping.

Use correct size of steam trap.

Flash-condensate to produce lower pressure steam.

Consider replacing condensing steam turbine rotating equipment drives with electric motors, if your plant has a power-generating capability.

Add traps to a distillation column to reduce the reflux ratio.

Insulate condensate lines.

Minimize boiler blowdown with better feedwater treatment.

Insulate steam lines.

Install steam traps.

Return steam condensate to boiler plant.

Use minimum steam operating pressure.

Use waste-heat low-pressure steam for absorption refrigeration.

Replace barometric condensers with surface condensers.

Shut off steam traps on superheated steam lines when not in use.

Optimize operation of multistage vacuum steam jets.

Use insulation of optimum thickness.

Use reflux ratio control or similar control instead of flow control on distillation towers.

Substitute hot process fluids for steam.

Other Utilities

Immediate Action

Clean fouling from water lines regularly.

Shut off cooling water when not required.

Reduce business travel by using telephone when possible.

Conduct monthly audit of water meters for early leak detection.

Clean or replace air filters regularly.

Remove unneeded service lines to eliminate potential leaks.

Eliminate leaks in combustible gas lines.

Eliminate leaks in inert gas and compressed air lines and valves.

Eliminate leaks in water lines and valves.

Shut off all laboratory fume hoods when not in use.

Other Suggestions

Install adequate dryers on air lines to eliminate blowdown.

Install compressor air intakes in coolest locations.

Recover and reuse cooling water.

Do not use compressed air for personal cooling.

Use flow-control valves on equipment to optimize water use.

Evaluate water cooling vs. air cooling for specific situations.

Eliminate cooling of process streams that subsequently must be heated, and vice versa.

Shut off cooling if cold outside air will cool process.

Use cascade system of recirculating during cold weather to avoid subcooling.

Operate cooling towers at constant outlet temperature to avoid subcooling.

Use minimum cooling water to bearings.

Increase the level of the water in a drainage ditch to reduce the pumping head and horsepower required where drainage water must be pumped over a levee for disposal.

Reduce sewer liquid volume, which reduces treatment energy by returning steam condensate to boilers.

Replace oversize motors and pumps with optimum size.

Reduce the pressure of compressed air to the minimum required.

Reduce hot-water temperature to the minimum required.

Recycle treated water.

Eliminate compressed air drives from permanent installations.

Heat Recovery

Use the overhead condenser to generate steam from condensates in a distillation process.

Use hot flue gases in radiant heater for space heating, ovens, dryers, etc.

Use heat in flue gases to preheat products or material going into ovens, dryers, etc.

Use hot process fluids to preheat incoming process fluids.

Use hot flue gases to preheat wastes for incinerator boiler.

Use waste heat from hot flue gases to generate steam for processes or consider selling excess steam.

Use waste heat from hot flue gases to heat space conditioning air.

Use waste heat from hot flue gases to preheat combustion air.

Use engine exhaust heat to make steam.

Recover fuel value in polluted exhaust air.

Recover fuel value in waste byproduct.

Use flue gases to heat process or service water.

Use oven exhaust for space heating.

Use recovered heat from lighting fixtures for useful purpose — e.g., to operate absorption cooling equipment.

Use flue gas heat to preheat boiler feedwater.

Use cooling air that cools hot work pieces for space heating or make-up air in cold weather.

Heat Confinement

Repair faulty insulation in furnaces, boilers, etc.

Other Suggestions

Use economic thickness of insulation for low temperatures.

Use soft insulation in cycling furnaces to facilitate heating up and cooling down.

Use minimum-safety oven ventilation.

Upgrade insulation and linings in furnaces, boilers, etc.

Repair furnaces and oven doors so that they seal efficiently.

Combustion

Immediate Action

Calculate and plot boiler efficiency daily.

Establish burner maintenance schedule.

Adjust burners for efficient operation.

Other Suggestions

Improve combustion-control capability.

Heat oil to proper temperature for food atomization.

Eliminate combustible gas in flue gas.

Reduce combustion air flow to optimum.

Convert combustion to more efficient fuel.

Use waste and byproducts as fuel.

Replace obsolete burners with more efficient ones.

Limit secondary combustion air in furnace operations to the amount required for proper furnace operation.

Scheduling

Shut down process heating equipment when not in use.

Other Suggestions

Indicate causes of electrical power demands and peak charges and reschedule plant operations to avoid peaks.

Reduce temperature of process heating equipment when on standby.

Use most efficient equipment at its maximum capacity and less efficient equipment only when necessary.

Heat-treat parts only to required specifications or standards.

Schedule routine maintenance during nonoperating periods.

Consider three or four days around-the-clock operation rather than one or two shifts per day.

Minimize operation of equipment required to be maintained in standby condition.

Reduce operating time of equipment to that actually required.

Optimize production lot sizes and inventories.

Handling of Materials

Immediate Action

Turn off conveyors, lift trucks, etc., when not in use.

Recharge batteries on materials-handling equipment during off-peak demand periods.

Adjust and maintain fork lift trucks for most efficient operation.

Shut down diesel construction equipment when not needed.

Other Suggestions

Use equipment of optimum size and capacity.

Upgrade conveyors.

Use gravity feeds wherever possible.

Process Changes

Coordinate baking times of small and large components to minimize use of energy.

Use vapor recompression design in distillation processes.

Use 'side draw' principle in distillation column design.

Use continuous equipment that retains process heating conveyors within the heated chamber.

Use direct flame impingement or infrared processing for the chamber type of heating.

Convert from indirect to direct firing.

Convert from batch to continuous operation.

Use the shaft type of furnace for preheating incoming material.

Convert liquid heaters from underfiring to immersion or submersion heating.

Minimize unessential material in heat-treatment process.

Change product design to reduce processing energy requirements.

Reduce scrap production.

Upgrade obsolete or little-used equipment.

Appendix A

The Enterprise Development Program (EDP)

Effective April 1, 1977 the Enterprise Development Program (EDP) replaced the following Industry, Trade and Commerce innovative and adjustment assistance programs:

- **PAIT** — Program for Advancement of Industrial Technology
- **IDAP** — Industrial Design Assistance Program
- **PEP** — Program to Enhance Productivity
- **GAAP** — General Adjustment Assistance Program
- **AAA** — Automotive Adjustment Assistance Program
- **FTIAP** — Footwear and Tanning Industry Adjustment Program
- **PIDA** — Pharmaceutical Industry Development Assistance Program

EDP combines the basic features of these programs and is designed to facilitate coordination amongst various forms of assistance making Industry, Trade and Commerce programs more accessible to Canadian industry, particularly smaller and medium-sized businesses.

The EDP Program is administered by the Enterprise Development Board and the regional Enterprise Development Boards all of which report to Cabinet through the Minister of Industry, Trade and Commerce.

EDP Objective

The overall objective of the EDP Program is to enhance the growth in the manufacturing and processing sectors of the Canadian economy by providing assistance to selected firms to make them more viable and internationally competitive.

The thrust of the EDP Program is to increase the effectiveness of the Department's industrial support programs to foster innovation and adjustment. The focus for assistance is on promising smaller and medium-sized firms prepared to undertake relatively high risk projects in relation to their resources which are viable and promise attractive rates of return on the total investment.

How EDP Works

There is a typical product life cycle through which all products pass. Generally, this cycle entails the following distinct phases:

a) concept
b) development
c) pre-production
d) production
e) marketing

Previously, incentive and development programs have been oriented to certain phases of the product life cycle. For example, PAIT was oriented to the concept, development and pre-production phases, while GAAP was oriented to the pre-production, production and marketing phases.

But there are differing problems and risks facing a firm at all phases of the product life cycle. The corporate approach endeavours to examine all of the problems and risks facing a firm at each of the distinct phases of a product life cycle.

Standard operating policy for the EDP Program is to adopt the corporate approach to analysis, that is, to undertake a rigorous analysis of applicant firms and their proposed projects to identify viable businesses with attractive future prospects. The orientation is towards the business plan of the firm to identify present and future requirements for assistance and to tailor one or more forms of assistance under the program together with other government assistance and private sector financing into a "do-able" financing package to suit the applicant company.

This flexible approach is described as "merchant banking" flexibility. A merchant bank is defined as a financial institution which endeavours to serve its clients by identifying, structuring and providing (or arranging for) all of the types of financing, and financial and management services which are required by a firm to realize its full potential.

This approach may be described as investing in firms, not just supporting projects.

The corporate/merchant banking approach is similar to that of an investor. That is, the approach is to examine the resources of the firm (human, financial, physical and technological); to examine the market opportunities and constraints; and to examine the plans of the firm to marshall its present and attainable resources to exploit its present and future market opportunities.

The Decision-Making Structure

The decision-making structure for the program is addressed in two ways:

a) The decision-making structure for the program is mixed private sector/public sector boards. This is designed to provide pragmatic, market-oriented decisions by using the experience of prominent businessmen in the decision-making process. Further, this provides the responsible officers with guidance and advice in the analysis of firms, and in structuring "do-able" packages of assistance.

Strict confidentiality and conflict of interest guidelines protect the competitive interests of applicant firms.

b) Secondly, the decision making is decentralized to a greater extent with the creation of regional boards with delegated approval limits. This is designed to provide faster decision making and an awareness of regional business conditions in the decision-making process.

Forms of Assistance

The following components of the EDP Program indicate the various forms of assistance available:

a) grants to develop proposals for projects eligible for assistance
b) grants to study market feasibility
c) grants to study productivity improvements projects
d) grants for industrial design projects
e) grants for innovation projects
f) loans and loan insurance for restructuring (plant expansion, equipment modernization, working capital, etc.)
g) special purpose forms of assistance-surety bond guarantees, footwear or tanning industries assistance, DHC-7 sales financing assistance.

Within the context of the overall objective of the EDP Program, each of the various forms of assistance has sub-objectives as described below:

a) Grants to Develop Proposals for Projects Eligible for Assistance

In order to ensure that the more complex proposals for innovation and adjustment assistance are developed on a viable, adequately researched and workable basis, grants to partially offset the cost of qualified consultants can be provided to this end.

b) Grants to Study Market Feasibility

Projects for innovation and restructuring often falter or fail due to problems related to markets and marketing. To reduce the risk of projects in this regard, grants to partially offset the cost of the services of expert consultants in this field can be provided before innovation or adjustment assistance is considered.

c) Grants to Study Productivity Improvement Projects

To encourage feasibility studies of productivity improvement measures which do not require technology which is new to the firm but do involve some risk, grants to partially offset the cost of consultants qualified to conduct such feasibility studies can be provided.

d) Grants for Industrial Design

The objective of grants for industrial design is to assist and to generally promote greater use of qualified industrial design services for products to be mass produced.

e) Grants for Innovation Projects

The purpose of innovation assistance is to increase technological innovation in Canada where it will lead to industrial growth and economic benefit to both the firm and to the Canadian economy. Grants can be provided to selected projects concerned with the development of new or improved products and processes or service capability incorporating an advance in technology and offering good prospects for profitable commercial exploitation.

Due to the risk and uncertainty which accompany innovation projects, this type of assistance should frequently be provided in conjunction with other forms of assistance, for example, grants to study market feasibility.

f) Loans or Loan Insurance for Adjustment Projects

The basic purpose of the adjustment assistance aspects of the EDP Program is to facilitate restructuring or rationalization of manufacturing and processing firms in Canada by providing last resort financial assistance. Canada's secondary manufacturing industries frequently have considerable difficulty in meeting international competition both at home and in export markets. While the problems are numerous and complex, one frequent problem is that Canadian manufacturers have in many cases been geared to serve domestic markets under protective tariffs. In order to enhance the viability of secondary manufacturing and processing and to permit Canadian firms to become more internationally competitive, massive private investment in restructuring operations and modernizing equipment and facilities is required. In some cases, usual sources of financing for this purpose are inadequate for some smaller and medium-sized firms and in these cases, loan insurance (guarantees) can be provided through the adjustment assistance components of the Enterprise Development Program.

Direct loans can also be provided to viable Canadian firms engaged in manufacturing or processing but this assistance is restricted to cases where firms have been injured by import competition.

Due to the risks frequently associated with last resort financial assistance, this type of assistance may frequently be provided in conjunction with other forms of assistance, for example, grants to develop restructuring proposals or grants to study productivity improvement projects.

g) Special Purpose Forms of Assistance

The adjustment assistance aspects of the Program are occasionally utilized to structure special purpose forms of assistance to meet more specific objectives.

Three forms of special purpose assistance which are in place are:

i) loans and grants to encourage restructuring of firms engaged in footwear or tanning industries;
ii) insurance on surety bonds for off-shore turnkey projects; and
iii) insurance on loans, leases and conditional sales agreements to air carriers in Canada and the United States to acquire de Havilland DHC-7 aircraft.

These three special purpose forms of assistance are administered by the Central Board and are not included in the delegated approval authority of the regional boards.

Who is Generally Eligible for Assistance?

As a general statement, the orientation of the Enterprise Development Program is to provide assistance to smaller and medium-sized firms engaged in manufacturing or processing activities. Firms in the service sector are, under limited circumstances, also eligible provided the provision of services provides direct, tangible and significant benefit to firms engaged in manufacturing or processing, or the project (such as an innovation project) is to be exploited by a firm engaged in manufacturing or processing activities.

As a matter of policy, the Board will restrict the availability of such assistance to cases where the benefiting manufacturing firm is eligible for assistance.

Applicants for innovation and industrial design assistance must be incorporated. Firms applying for adjustment assistance need not be incorporated to be eligible. However, it is highly desirable that all firms are incorporated before receiving assistance, not only for the Crown's benefit but also for their own benefit. The Crown prefers to deal with limited companies as non-personal legal entities. From the firm's point of view, incorporation provides protection to its principals by limiting their liability under business obligations.

Each of the various forms of assistance has certain criteria, but generally, the eligibility criteria are as follows:

a) the firm and the project must be viable;
b) for loans and loan insurance, the firm must be unable to obtain financing on reasonable terms; and
c) for grants, the project must represent a significant burden to the firm in respect of its resources.

For more information on the Enterprise Development Program please contact The Program Office, IT&C Ottawa or your nearest Industry, Trade and Commerce Regional Office.

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Appendix B

Example of an Energy Budget Theoretical Calculation

For the purpose of this example it is assumed you are trying to calculate the potential energy saving from insulating a water wash tank in the plating room.

The tank is filled and heated every Monday morning in 1 hour starting at 7 A.M. and maintained at 150°F until it is drained on Friday afternoon at 5 P.M. (a total of 106 hours). This happens 50 times a year.

The work load of the tank (i.e., parts washed) amounts to 100 pounds of steel per hour. The parts are immersed in the water for 1 hour, entering at 70°F, 8 hours a day.

The tank is 2 feet wide, 3 feet long and 2 feet deep.

The water depth is 1½ feet and is maintained at this depth by adding make-up water at the rate of 1 gallon per hour. Fresh water temperature is 50°F. The room temperature is 70°F.

The total *theoretical* energy input to the dipping tank is calculated for two conditions: tank walls uninsulated and no cover on top, and tank walls insulated with 1 inch of foamed polystyrene and top covered with plastic spheres.

Physical Constants

Water	
sp. ht.	— 1.0 Btu/lb/°F
heat of fusion	— 140 Btu/lb
heat of vaporization	— 960 Btu/lb
density	— 62.4 lb/cu ft
Steel Tank	
sp. ht.	— .12 Btu/lb/°F
density	— 492 lb/cu ft
thickness	— ⅛ inch

Weights and Areas

Volume	= 2′ × 3′ × 1½′	= 9 cu ft
Wt. of water	= 9 × 62.4	= 561.6 lb
Area	= 3(2 × 3) + 2(2 × 2)	= 26 sq ft
Wt. of tank steel	$= \frac{26 \times .125 \times 492}{12}$	= 133.3 lb
Top area	= 2′ × 3′	= 6 sq ft

Formula

Start-up heat = wt. (lb) × sp. ht. (Btu/lb/°F) × temp. rise (°F) plus wt. (lb) × heat of fusion/vaporization (Btu/lb)*

* Applies to phase change only.

				Tank: Uninsulated[1] (Btu)	Insulated (Btu)
Start-up heat absorbed by:					
Water	= 561.6 × 1.0 × (150° − 50°)			56 160	56 160
Tank Steel	= 133.3 × .12 × (150° − 50°)			1 600	1 600
	Total absorbed			57 760	57 760
Losses[2] from:		Uninsulated	Insulated		
Tank sides	= 26 sq ft at	188 Btu/sq ft	28 Btu/sq ft	4 900	730
Water surface	= 6 sq ft at	917 Btu/sq ft	228 Btu/sq ft	5 500	1 370
	Total losses per hour			10 400	2 100
Working heat absorbed by:					
Steel parts	= 100 lb × .12 × (150° − 70°) + 0			960	960
Make-up water	= 10 lb × 1.0 × (150° − 50°) + 0			1 000	
Make-up water	= 2.5 lb × 1.0 × (150° − 50°) + 0				250
	Total working heat used per hour			1 960	1 210
Operation Summary					
Start up heat — absorbed in first hour				57 760	57 760
Losses (i) average loss in first hour = $\frac{\text{total losses per hour}}{2}$				5 200	1 050
(ii) losses per hour × 105 hours per week				1 092 000	220 500
Working heat used per hour x 8 hr x 5 days per week				78 400	48 400
Total theoretical energy input per week				1 233 360	327 710
Theoretical Weekly Saving (73.5%)					905 650

[1]This is a theoretical calculation of energy requirements for an uninsulated tank. In practice, temporary metering should be used to determine the actual energy being used.
[2]Available from published curves.